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Gastric Areas (*areae gastricae*)

Pola żołądkowe (*areae gastricae*)

Желудочные поля (*areae gastricae*)

It is generally known that mucous tunic of stomach consists of three structures:

a) longish folds, 10 in number, running on the anterior and posterior walls of the stomach;

b) gastric areas (*areae gastricae*) of 1—6 mm section which can be detected by radiological examination and particularly by di-contrastive one;

c) gastric foveolas (*foveole gastricae*) unseen with the unaided eye.

Gastric areas have been described for several decades in histology and anatomy text-books and they were considered to be microscopic sculptures or a picture of the micromucosa (4, 5). They were contrasted with macromucous or macroscopic picture formed by gastric sulcus (*rugae gastricae*). About twenty years ago, Friik (4, 5) noticed that gastric areas can be detected radiologically with use of barium sulphate during the examination of a stomach when a careful technique with moderate pressure is applied. He stated that changes in the picture of gastric areas made better signal (indicator) for the estimation of gastritis — *gastritis atrophicans* (4—7). Then he mentioned that although the possibility to indicate the increase of micromucosa does not necessarily determine the pathological state of mucosa tunic, yet the indication of the proper state of gastric areas most probably eliminates presence of diffused shape of atrophic endogastritis $\pm 10\%$ (7). When the irregularly increased areas with diameter of more than 3 mm can be observed then the frequency of indication of atrophic endogastritis would be about $97.5 \pm 5\%$. Much experience of the author indicates that the problem of radiological evaluation of gastric areas is essential and complicated.

Aoyama (1) also noticed great dependence of gastric areas morphology upon the results of histopathologic examinations in respect to atrophic endogastritis. This interdependence of endoscopic assessment of endogastritis and abnormality of gastric areas was noticed in 98%.

A picture of gastric areas seen by a radiologist is in a shape of mosaic formed by barium sulphate layer in grooves of mucous tunic. The distance between grooves changes from 1 mm to 4—5 mm, and the surface of a little raised mucous tunic joined by grooves makes so-called gastric areas. They are surrounded by grooves of about 0.5 mm breadth and 0.3—0.4 mm of depth.

The studies conducted by McKintosh and Kreel (19) on pigs' stomachs enabled the anatomic evaluation of gastric areas from two points of view: from radiological point of view and anatomic one. These studies proved that when the layer of mucus is thick then a thin layer of barium sulphate does not expose sufficiently gastric areas. The authors indicated explicitly that the grooves covered by barium sulphate corresponded to anatomic grooves in mucous tunic of the stomach (19). They compared the picture of mucous tunic of the stomach seen in front of an irregularly ploughed field with spaces between drills containing numerous holes (Fig. 1). The authors emphasized that the surface of a raised mucous tunic of the stomach is one of its characteristic anatomic features and it does not depend upon the state of tension of mucous tunic muscularis (*muscularis mucosae*) — Fig. 2. They showed experimentally the difference in the picture of gastric areas within the limits of separate parts of the stomach. In the body of the stomach, the grooves are much more broad with so-called thick mosaic picture. Anatomic picture of the fundus of the stomach has a different distance between two grooves than that in the pyloric part or in the body of the stomach. Fossulae in the pyloric part both of human and pig's stomachs were deeper than fossulae in the fundus. It was also underlined in the work of Leszczyński (18), who as the Japanese authors, distinguished three types of gastric areas, i.e. A, B, C. In the studies of many authors, mostly of Japanese origin, in the type A₁, areas are of the same size with clearly deep grooves. In type A₂, the grooves are shallow. Type B contains the areas of different size, partially declining, with deep grooves in the type B₁ and shallow ones in the type B₂. In type C, gastric areas are invisible, the grooves are blurred by swelling or infiltration (12).

Miller's report in which he summed up the works of McKintosh and Kreel and of Seam revealed the additional importance of factors influencing good manifestation of gastric areas which were omitted and were not discussed by the mentioned authors (19). One of the factors is the thickness of the barium sulphate suspension and the

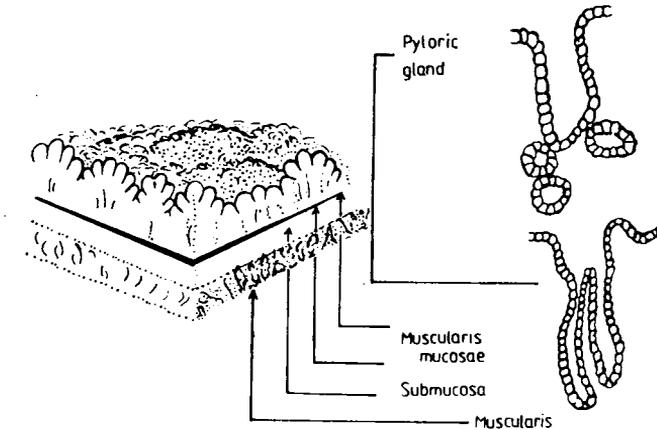


Fig. 1. Anatomic picture of gastric areas

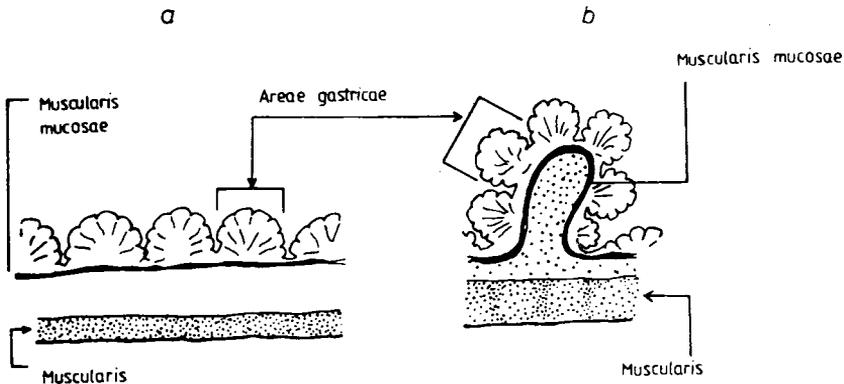


Fig. 2. State of tension of mucous tunic muscularis, a — relaxed stomach, b — contracted stomach wall with rugal fold

size of its modules. This author underlines in his work that the thickness of barium sulphate suspension and the size of its modules have a vital influence upon a good picture of gastric areas. He explains it in this way that large modules settle quicker and fill the grooves surrounding gastric areas. These grooves are better seen in the di-contrastive examination because of the greater thickness of large barium sulphate modules. He also emphasized that large modules of barium suspension have a deterrent effect on the mucous tunic of the stomach and they remove its mucous coat which hinders the penetration of barium sulphate within the grooves surrounding the holes.

Cumberland (3) stressed in his work the role of another factor, that is stickiness of suspension. The stickiness of the suspension is of great importance for the process of covering with mucous tunic. The

suspension which is less sticky is mixed and dissolved with mucous layer in a greater degree than that of greater stickiness. It was also proved by experiments of another authors (2, 3, 8, 16, 19).

All the authors emphasize in concert that the main agents enabling gastric areas manifestation are proper preparation of a patient and the method of examination in double contrast conditions. Miller (19) puts emphasis on the fact that patients in Japan were put in rotary motion round long body axis about 40—50 times in order to get proper covering of mucous tunic with suspension. With such careful "scrubbing" ("covering"), rearches from Japan got radiograms of excellent quality. Skukas also stated that covering of stomach mucous tunic is not only conditioned by the suspension of barium sulphate but also by chemical agents preventing formation of foam, such as siloxans (silicon compounds). Therefore, when double contrast method is used it is necessary to settle upon the kind, concentration and amount of contrast medium that is to be used during the examination. It is also necessary to specify the amount of gas, relaxation degree of muscular coat treated with hypotonic drugs, succession and duration of administration. All these factors should be taken into consideration because they influence the removal of mucus and good presentation of gastric areas (Fig. 3). When double contrast is applied, the areas are visible in 70% of examined cases and the Japanese authors managed to demonstrate them in 100% while adopting proteinase covering.

In clinical gastroenterology, gastritis, beside peptic ulcer and cancer, occurs most often and it makes the most difficult problem for diagnostics. The notion of gastritis includes diffused or limited changes in mucous tunic which can be defined, from histological point of view, as inflammation composed of infiltration focuses of lymphocytes, leukocytes, and plasmocytes surpassing the proper stratum (11, 13, 14). There is no close correlation among the results of clinical, gastroscopic, radiological or histopathological examinations. And especially the lack of conformability in results of endoscopic and radiological examinations makes the explicit evaluation of the change more difficult. It is generally accepted opinion that in the assessment of chronic gastritis the most important is the examination of newly collected segments of mucous tunic (6, 13, 14). Radiological or gastroscopic examinations may only suggest the hypothetical type of gastritis. The following kinds of gastritis may be distinguished in the classification based on endoscopic and histological examinations: hydrophic gastritis, superficial gastritis, atrophic gastritis.

Among these categories, chronic atrophic gastritis is particularly worth of notice. Coexistence of chronic atrophic gastritis and stomach cancer is well known, although not all the clinicists agree with it.



Fig. 3. Radiological picture of gastric areas

Catarrhal changes observed during endoscopic, radiological and surgical examinations reveal probability of coexistence with stomach cancer (7).

It is, however, not certain whether the catarrhal changes are the accompanying or preceeding symptoms. The studies upon stomach cancer seem to indicate the predisposition of the patients with gastritis to have a stomach cancer. A natural history of chronic gastritis proves that the inflammation process is of progressive character and that it results in atrophy of mucous tunic.

The basic criterion for radiological assessment of chronic gastritis is the evaluation of the degree of mucous tunic folds pachynsis (thickening). Many factors may influence the described, and often too broad mucous tunic folds, and the inflammation process is not the most important one among these factors. The thickening of mucous tunic folds, in these cases, may result from mucous tunic muscularis spasm (*muscularis mucosae*) or hypertrophy of glandular layer — stratum (13). The appearance of mucous tunic still forms a vital element in radiological diagnosing of gastritis. Nowadays the gastric areas are considered to form the basic element in the assessment of some inflammatory states, their importance is stressed in the literature (2, 4—7, 12, 14, 15, 18, 19).

It is belived that the exposure to gastric areas in the case of atrophic gastritis is unstable and it depends not only upon standards of contrastive material but also upon the physiological state of mucous tunic (1, 7, 9). Despite the facts mentioned above, there are many proofs indicating the interdependence between outer appearance and frequency of gastric areas exposure in case of mucous tunic inflammation of atrophic catarrh type (1, 4—7, 10, 17). It is necessary to work out and describe scientifically a detailed technique of stomach mucous tunic examination when the exposure of gastric areas is to be the main evaluating factor of its physiological state. Seamen states that the exposure of gastric areas and micro mucous tunic picture is a proof for the proper technique and he believes that pathological lesion may be a symptom of significant meaning. These statements were confirmed by the work of McKintosh and Kreel (19). While analyzing clinical material, the authors stated that it was more likely to receive a good picture of small sculpture of mucous tunic when patients suffered because of duodenal ulcer than with healthy people. So, when the layer of mucus is thin, gastric areas are better seen and the duodenal ulcer is frequently spotted. It is much more difficult to show gastric areas when a patient has clear thick layer of mucus and the duodenal ulcer less frequent. It was confirmed by the experimental works with rats. These works confirmed that pharmacological devices which increase mucus secretion have a favourable influence upon treat-

ment of ulcers while sterides which cause the decrease of mucus secretion are conductive to development of an ulcer.

It should be also stressed that symmetricalness of gastric areas and the kind of chaos in their structure appear with patients who have an early stage of stomach cancer, in a postulcer scar and round a pelpic ulcer (12, 15, 18, 13). Superficial cancers of concave character caused destruction of grooves and gastric areas. This kind of destruction can be included in C type. In prominent superficial type of stomach mucous tunic gastric areas of C and B₂ types were most often (12). K e t o and co. (10) estimating gastric areas in gastritis, clearly stated the changeability of area structures according to the type of gastritis. When there is no change in mucous tunic, gastric areas have regular shape, they have 1—3 mm dimension with uninterrupted distinct grooves. With superficial gastritis, gastric areas are of irregular shape, they are of various dimension with average size 2—3 mm. With a mixed gastritis, the dimension of the areas is of 2—5 mm. With atrophic gastritis, areas are of irregular shape, most often they have 2—4 mm dimension, there are great differences among them and deep grooves surrounded by the areas.

Summing up it should be stressed that administration of barium sulphate suspension of great standards will be instrumental in obtaining a picture of micromucous tunic and this way it will enable the assessment of small ulcers, erosions and early stage of stomach cancer. With nowadays diagnosis, the di-contrastive examination of an alimentary duct and especially of a stomach forms quite new perspectiveives of assessment and enrich semiology of X-ray picture.

REFERENCES

1. A o y a m a D.: Radiological Diagnosis of Chronic Gastritis. 3rd World Congress of Gastroenterology, Tokyo 1966, 209.
2. C o l a g r a n d e C., V e c c h i o l i A.: Gastric Surface X-ray Contrast Examination with Suspension of BaSO₄ 250% v/v. *Rays* 2, 137, 1977.
3. C u m b e r l a n d D. C.: Optimum Viscosity of Barium Suspension for Use in the Double Contrast Barium Meal. *Gastrointest. Radiology* 2, 16, 1977.
4. F r i k W., Z e i d n e r A.: Röntgenuntersuchungen des Magenfeinreliefs. 1. Mitteilung. *Fortschr. Röntgenstr.* 79, 385, 1953.
5. F r i k W.: Röntgenuntersuchungen des Magenfeinreliefs. 2. Mitteilung. *Fortschr. Röntgenstr.* 88, 546, 1958.
6. F r i k W., H o u p - t o n W e n.: Röntgenuntersuchungen des Magenfeinreliefs. 3. Mitteilung. *Fortschr. Röntgenstr.* 101, 457, 1964.
7. F r i k W.: Further Experiences Concerning X-ray Diagnosis of Diffuse Chronic Gastritis by Evaluation of the Micromucosal Pattern of the Stomach. 3rd World Congress of Gastroenterology, Tokyo 1966, 212.

8. Gelfand D. W.: High Density Low Viscosity Barium for Fine Mucosal Detail of Double Contrast Upper Gastrointestinal Examinations. *Am. J. Roentgenol.* **130**, 831, 1978.
9. Herlinger H., Glanville J. N., Kreel L.: An Evaluation of the Double Contrast Barium Meal (DCBM) Against Endoscopy. *Clin. Radiol.* **28**, 30, 1977.
10. Keto P., Suoranta H., Tarpila S.: *Areae gastricae* and Gastritis in Double Contrast Barium Meal. *Fortschr. Röntgenstr.* **5**, 576, 1979.
11. Kirkpatrick J. R. et al.: The Recognition of Atrophic Gastritis. *Brit. J. Surg.* **56**, 742, 1969.
12. Koga M. et al.: Mucosal Patterns in Gastric Carcinoma. *Radiology* **120**, 199, 1976.
13. Konturek S.: Współczesne metody rozpoznawania nieżytu żołądka. *Pol. Tyg. Lek.* **24**, 1517, 1969.
14. Kopp E.: Gastritis-eine gefährliche Fehldiagnose. *Schweiz. Rundschau Med. (Praxis)* **62**, 180, 1969.
15. Kreel L.: The Surface Pattern of the Stomach. *Proceedings of the Royal Society of Medicine* **68**, 111, 1975.
16. Kreel L. et al.: A Technique for the *in vitro* Testing of Barium Preparation. *Radiography* **40**, 51, 1974.
17. Korman M., Makela P., Rossi J.: Visualization of the *areae gastricae* in Double Contrast Examination — Dependence on the Contrast Medium. *Fortschr. Röntgenstr.* **128**, 52, 1978.
18. Leszczyński S.: Badanie dwukontrastowe żołądka z uwidocznieniem pól żołądkowych. *Pol. Przegl. Radiol. i Med. Nauk.* **3**, 151, 1979.
19. MacKintosh C. E., Kreel L.: Anatomy and Radiology of the *areae gastricae*. *Gut.* **68**, 111, 1977.

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STRESZCZENIE

Przedstawiono historię rozwoju badań nad oceną, rozpoznawaniem i symptomatologią rentgenowską pól żołądkowych. Zwrócono uwagę na znaczenie badania dwukontrastowego w uwidocznieniu pól żołądkowych oraz na rolę zawiesin siarczanu barowego w ich ocenie. Podkreślono, że obraz pól żołądkowych (*areae gastricae*) jest przydatny w ocenie oraz wykrywaniu zmian patologicznych w żołądku ze szczególnym uwzględnieniem nieżytu zanikowego.

РЕЗЮМЕ

В данной работе автор знакомит с историей и развитием исследований связанных с оценкой, распознаванием и рентгеновской симптоматологией желудочных полей (*areae gastricae*). Он доказывает значение двухконтрастного исследования в выявлении желудочных полей, а также роль взвесей сульфата бария в их оценке. Автор подчеркивает бесспорную пригодность желудочных полей для оценки и обнаружения патологических изменений в желудке с особым учетом атрофического гастрита.

